

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.






5 credits

30.0 h + 30.0 h

Q2

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| Teacher(s) | Kerckhofs Greet ; |
| Language : | English |
| Place of the course | Louvain-la-Neuve |
| Main themes | <ul style="list-style-type: none"> • Fundamentals of the structure, function and biological performance of main biomechanical systems • Biomechanics of the musculoskeletal system • Biomechanics of the cardiovascular system • Introduction to the biomechanics of the respiratory system • Introduction to analytical and computational modelling of the systems mentioned above |
| Aims | <p>With respect to the AA referring system defined for the Master in Biomedical Engineering, the course contributes to the development, mastery and assessment of the following skills :</p> <ul style="list-style-type: none"> • AA1.1, AA1.2 • AA.2.1, AA2.3, AA2.5 • AA3.2, AA3.3 • AA4.2, AA4.3, AA4.4 • AA5.2, AA5.5, AA5.6 • AA6.3 <p>After this course, the student will be able</p> <ol style="list-style-type: none"> 1. to understand the structure and function, and their link, of the main biomechanical systems, to choose between different experimental characterization techniques of the structure and function of the main biomechanical systems, to make a choice between different analytical and computational model types according to the application, to use image analysis tools to study a biomechanical problem introduced in the course. <p>Transversal learning outcomes:</p> <ul style="list-style-type: none"> • Introduction to image analysis • Have a debate in group for peers • Collaborative reporting <p>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled 'Programmes/courses offering this Teaching Unit'.</p> <p>----</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p> |
| Evaluation methods | <p>Due to the COVID-19 crisis, the information in this section is particularly likely to change.</p> <ul style="list-style-type: none"> • Closed-book written examination • Projects with written reports and oral debate |
| Teaching methods | <p>Due to the COVID-19 crisis, the information in this section is particularly likely to change.</p> <ul style="list-style-type: none"> • Theoretical lectures • Exercise session to get acquainted with finite element simulations • Q&A sessions about the project |
| Content | <p>This course provides a link between the structure, function and biological performance of the main biomechanical systems: the musculoskeletal, cardiovascular and respiratory system. A brief introduction on the structure and function of these systems is provided, and the added value of both experimental characterization as well as computational modelling for a better understanding of the (mis)function of the main biomechanical systems is discussed, and examples of both are described in detail. The course aims at showing that engineering solutions,</p> |

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| | <p>such as experimental characterization and computational modelling, have their place in (bio)medical practice to solve biomechanical problems.</p> <p>The first part of the course deals with cell biomechanics and the musculoskeletal system, and the second part with the cardiovascular system. The third part introduces the main biomechanical aspects of the respiratory system. During the exercise sessions, an introduction will be provided into some experimental characterization techniques of the biological systems (mini-project), as well into analytical solutions for (bio)mechanical questions.</p> <p>For the project work, several biomechanical topics will be introduced, for which a dedicated journal paper will be provided focusing on an experimental (Group A) and a computational (Group B) solution. Per topic, Groups A and B will need to defend the strengths of their methodology in an orchestrated debate. Based on these debates, the groups will need to propose future research solutions (independent of their methodology of focus in the debate) to improve the current state-of-the-art, as summarized in a short written report.</p> |
| Inline resources | <p>Moodle</p> <p>https://moodleucl.uclouvain.be/course/view.php?id=9104</p> |
| Bibliography | <ul style="list-style-type: none"> • "Biomechanics", F. Henrotte, E. Marchandise, 2017 • Introductory Biomechanics : From cells to organisms; C. Ross Ethier and Craig A. Simmons (Cambridge Texts in Biomedical Engineering) |
| Faculty or entity in charge | GBIO |

| Programmes containing this learning unit (UE) | | | | |
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| Program title | Acronym | Credits | Prerequisite | Aims |
| Master [120] in Biomedical Engineering | GBIO2M | 5 | |  |
| Master [120] in Mechanical Engineering | MECA2M | 5 | |  |
| Master [120] in Computer Science and Engineering | INFO2M | 5 | |  |
| Master [120] in Mathematical Engineering | MAP2M | 5 | |  |
| Master [120] in Electro-mechanical Engineering | ELME2M | 5 | |  |